STT 200 SEC 9-12 1-11-10 CH 14

Note Title 1/11/2010

INTRO TO PROBABILITY CH 14 → 17 (EXAM 1 FOLLOWS)

CH 14 STRIPPED DOWN PROBABILITY

P(RAINS SATURDAY) = .2

P(RAINS SUNDAY) = .4

P(RAINS SAT OR SUN (OR BOTH))

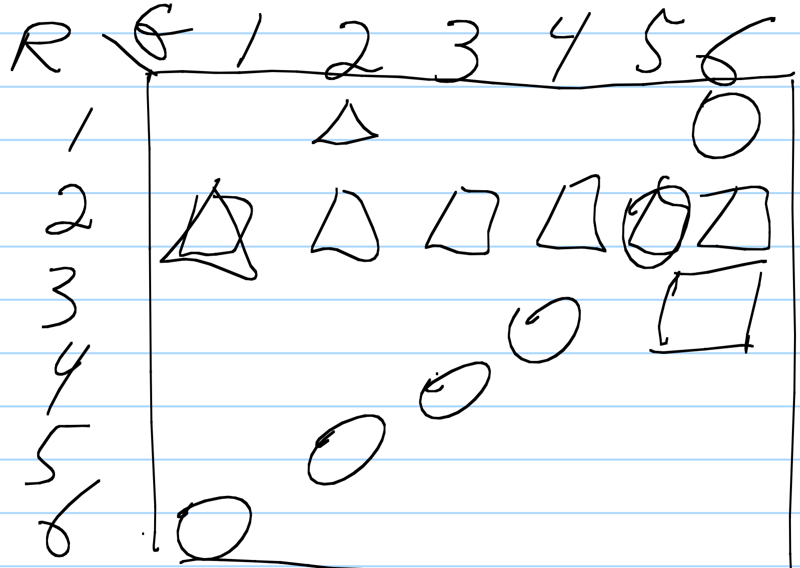
SEE CH 15

$\underset{\text{NAIVE THINKING}}{=}$ P(SAT) + P(SUN) − P(RAINS SAT AND SUN)

CLASSICAL NOTION OF PROBABILITY:

- FINITE # OF POSSIBLE "OUTCOMES"

eg TOSS RED DIE WITH GREEN DIE



EACH OF 36 "OUTCOMES" HAS PR $1/36$

$P(R = 3 \text{ AND } G = 6) = 1/36$

? $P(R = 2) = 6/36 = 1/6$

? $P(R + G = 7) = 6/36 = 1/6$

$P(R + G = 3) = 2/36 = 1/18$

$R = 1 \; G = 2$

$R = 2 \; G = 1$

JACK + JILL. $1 $1 $5

JACK FIRST THEN JILL FROM THE TWO THEN REMAINING.

INTUIT ? $P(\text{JACK } \$5) = 1/3$

? $P(\text{JILL } \$5) \quad 1/3$

$P(\text{JILL } \$5)$

$= P(\text{JACK } \$1 \text{ and JILL } \$5)$

$= \cancel{2/3} \cdot \cancel{1/2} = 1/3$

MODEL $1 $1 $5

a b c

JACK	JILL
a	b
a	c
b	a
b	c
c	a
c	b

IN THIS MODEL

$P(\text{JACK } 5) = 2/6 = 1/3$

$P(\text{JILL } 5) = 2/6 = 1/3$

USES OF PROBABILITY?

① 2008 NADA Jim LENTZ (CHM. TOYOTA N.A.)

"CUST COMES ONCE FOR SERVICE INCR PROBY OF CAR PURCHACE BY $\frac{1}{3}$"

BE CAUTIOUS — WHAT'S THE MODEL?

RANDOMIZED TRIAL OF SPECIFIC ATTRACTION TO SERVICE + WHETHER THAT LEADS TO A PURCHASE

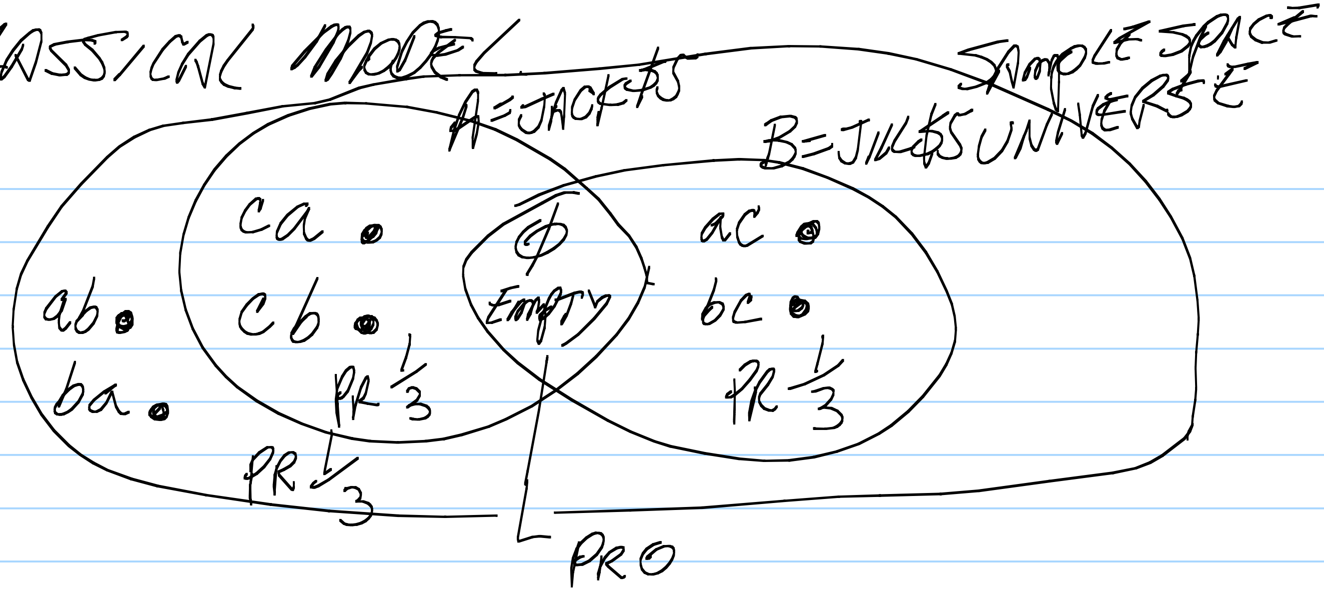
② DR POTCHEN:

CHANGES IN A FORM ASKING WHAT A RADIOLOGIST FINDS IN (SAY) XRAY IMAGE CAN IMPROVE ON DIAGNOSIS.

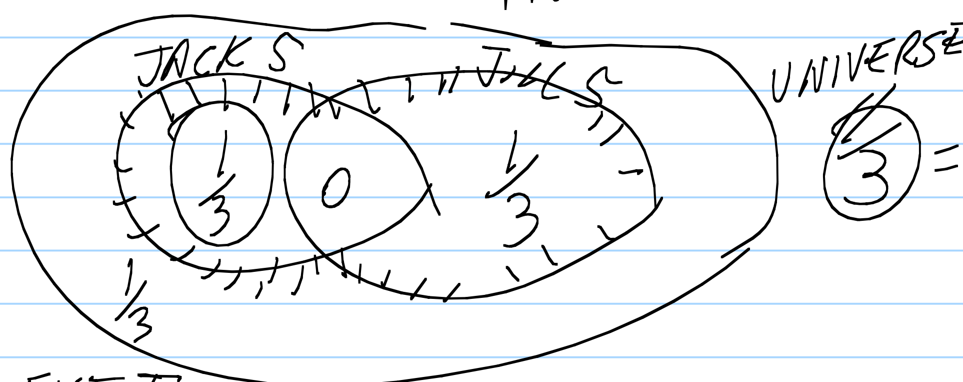
RETURN TO THE CLASSICAL MODEL

VENN DIAGRAM

JACK	JILL
a	b
a	c
b	a
b	c
c	a
c	b



RECALL ∅ IS BILL "C"



$\frac{1}{3}$ = P(JACK 5 JILL DOES NOT)

SEE THAT

P(JACK 5 OR JILL 5) $= \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

TEXT CH 14 DISJOINT EVENTS.

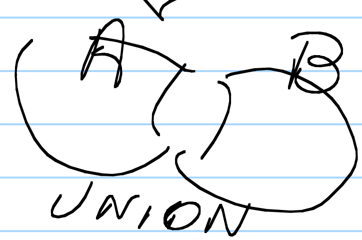
JACK 5 DISJOINT FROM JILL 5

THEY CANNOT OCCUR TOGETHER.

SO, <u>BECAUSE</u> JACKS IS DISJOINT FROM JILLS

$$P(\text{JACK S OR JILL S}) \overset{\text{DISJOINT}}{=} P(\text{JACKS}) + P(\text{JILL S})$$

<u>RULE</u> IF IN CLASSICAL MODEL EVENTS A, B ARE DISJOINT THEN $P(\text{A OR B (OR BOTH)}) = P(A) + P(B)$.



$A \cup$
UNION
(OR)

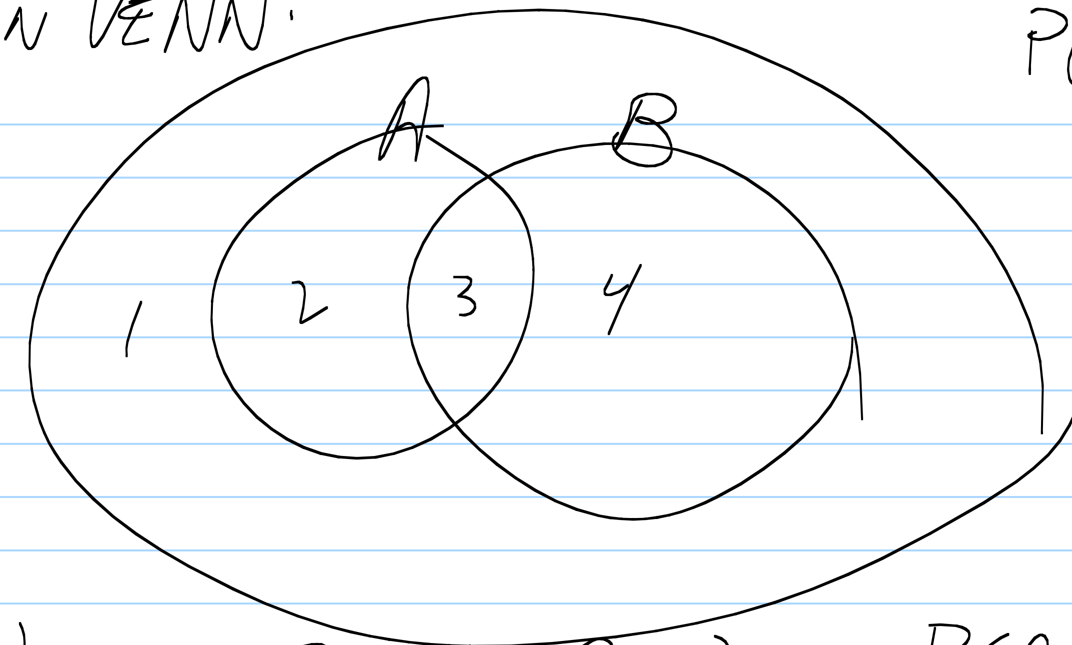
GENERAL ADDITION RULE:

$$P(A \underset{OR}{\cup} B) = P(A) + P(B) - P(A \underset{AND}{\cap} B)$$

AS SEEN IN VENN:

CLASSICAL

$P(A) = \frac{\#\ \text{FAVORABL}}{\#\ \text{TOTAL}}$



$$P(A \underset{\text{OR}}{\cup} B) = P(A) + P(B) - P(A \underset{\text{AND}}{\cap} B)$$

$$2+3+4 \qquad 2+3 \qquad 3+4 \qquad 3$$

DOUBLE COUNTED

CONNECTION OF RULES DEVELOPED FROM CLASSICAL MODELS WITH PROBABILITY GENERALLY.

IF e.g. STATEMENT $P(\text{RAIN TOMORROW}) = .2$ IS TO HAVE PRACTICAL VALUE, WE "IDEALLY" WOULD EXPECT ~ 20% OF THE OCCASIONS SUCH A "20%" STATEMENT IS MADE, THE OUTCOME (IN THIS CASE RAIN TOMORROW) ACTUALLY HAPPENS.

SO IF WE ARE TO "IDEALLY" JUDGE OUR PROBABILITIES BY HOW WELL THEY CONFORM TO RELATIVE FREQ COUNTS IN EXPERIENCE THEN CLASSICAL PROBABILITY RULES MUST APPLY.

SO, SUM UP, CLASSICAL PR MODEL

ADDITION RULE (CH 15): $P(A \underset{or}{\cup} B) = P(A) + P(B) - P(A \underset{and}{\cap} B)$

MULT RULE (CH 15)

$P(A \text{ and } B) \overset{NAIVE}{=} P(A)P(B)$

↑ IF DISJOINT THIS IS 0 CH 14.

RECALL HOWEVER $P(\text{Jack 5 and Jill 5}) = 0$

$\neq P(\text{JACK 5})\, P(\text{JILL 5}) = \frac{1}{9}$

$P(A \underset{and}{\cap} B) \underset{ALWAYS}{=} P(A)\, P(B \underset{IF}{|} A)$

eg $P(\text{JACK \#1 and JILL \#5}) = P(\text{JACK \#1})\, P(\text{JILL \#5} \underset{IF}{|} \text{JACK 1})$

$= \frac{2}{3} \cdot \frac{1}{2} = \frac{1}{3}$ YES!

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